PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-322547
(43)Date of publication of application : 08.11.2002

(51)Int.Cl. C22C 47/08
C22C 1/10
C22C 47/06

(21)Application number : 2001-128030
(22)Date of filing : 25.04.2001

(71)Applicant : TAIHEIYO CEMENT CORP
CELANX KK
(72)Inventor : SHIMOJIMA HIROMASA
HIGUCHI TAKESHI

(54) THIN PLATE AND PRODUCTION METHOD THEREFOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an inexpensive, thin plate which has a flatness higher than that of aluminum or an aluminum alloy, and is hard to be cracked and chipped compared with ceramics, and a production method therefor.
SOLUTION: The thin plate consists of a metal-ceramics composite material using ceramics powder or ceramics fiber as a reinforcing material, and aluminum or an aluminum alloy as a matrix.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The light-gage plate characterized by consisting of metal-ceramic composite material which consists of the aluminum or the aluminum alloy which is the ceramic powder or ceramic fiber which is reinforcement, and a matrix.
[Claim 2] The light-gage plate according to claim 1 characterized by for the thickness being [for said light-gage plate] 1-5mm or less, and the magnitude being beyond 100mm angle or more than 100mmphi.
[Claim 3] The manufacture approach of the light-gage plate characterized by forming preforming for the ceramic powder or ceramic fiber which is reinforcement, it being pressureless to the preforming in nitrogen-gas-atmosphere mind, making the fused aluminum or the aluminum alloy which is a matrix permeate it, producing composite material, and cutting the composite material to a slice.
[Claim 4] The manufacture approach of the light-gage plate characterized by forming preforming for the ceramic powder or ceramic fiber which is reinforcement, cutting the preforming to a slice, being pressureless to the cut preforming and making the fused aluminum or the aluminum alloy which is a matrix permeate it in nitrogen-gas-atmosphere mind.
[Claim 5] The manufacture approach of the light-gage plate according to claim 3 or 4 characterized by for the thickness being [for said light-gage plate] 1-5mm or less, and the magnitude being beyond 100mm angle or more than 100mmphi.

[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the light-gage plate which consists of metal-ceramic composite material, and its manufacture approach about a light-gage plate and its manufacture approach.
[0002]
[Description of the Prior Art] The crevice for a chip is established in the heater plate which heats to soak the wafer used for semiconductor fabrication machines and equipment etc., and a glass substrate, or a plate, and the light-gage plate is used for the chip heating plate which lays a chip in the crevice and soak-izes a chip, or the plate for heating which heats electronic parts.
[0003] Ceramics, such as metals, such as aluminum or an aluminum alloy, or an alumina, alumimium nitride, and silicon carbide, is conventionally used for the ingredient of this light-gage plate.
[0004]
[Problem(s) to be Solved by the Invention] However, it was difficult to process an about [phi300mm] disk with a sufficient precision at above mentioned aluminum or the above mentioned aluminum alloy, if the thickness is used as thin meat at 5mm or less since rigidity is low, and it difficult to produce a plate with good flatness. Furthermore, since the coefficient of thermal expansion was large, when heat was applied, there was also a problem that flatness got worse greatly.
[0005] Moreover, with the ceramics, since rigidity was high, the plate with good flatness was producible, but since the toughness was low, there was a problem that a crack and a chip arose with some impacts. Furthermore, in order to produce the above mentioned disk, there was also a problem that the manufacturing cost was very high.
[0006] This invention is made in view of the technical problem which the light-gage plate mentioned above has, and the object has flatness better than aluminum or an aluminum alloy, and is from the ceramics to be hard to lack, and offer the cheap light-gage plate of cost, and also offer [a crack or] the manufacture approach.
[0007]
[Means for Solving the Problem] if the composite material which turns into an ingredient of a light-gage plate from a metal and the ceramics is used as a result of inquiring wholeheartedly, in order that this invention person etc. may attain the above-mentioned object -- aluminum or an aluminum alloy -- flatness -- good -- the ceramics -- a crack and a chip -- hard -- moreover, knowledge that the cheap light-gage plate of cost is obtained is acquired, and it came to complete this invention.
[0008] namely, -- the light-gage plate (claim 1) characterized by this invention consisting of metal-ceramic composite material which consists of the aluminum or the aluminum alloy which is the ceramic powder or ceramic fiber which is (1) reinforcement, and a matrix -- carrying out -- (2) -- said light-gage plate It considers as the light-gage plate (claim 2) according to claim 1 characterized by for the thickness being 1-5mm or less, and the magnitude being beyond 100mm angle or more than 100phimm. (3) Preforming is formed for the ceramic powder or ceramic fiber

which is reinforcement. It is pressureless to the preforming in nitrogen-gas-atmosphere mind, make the fused aluminum or the aluminum alloy which is a matrix permeate it, and composite material is produced. It considers as the manufacture approach (claim 3) of the light-gage plate characterized by cutting the composite material by the slice. (4) Preforming is formed for the ceramic powder or ceramic fiber which is reinforcement. the manufacture approach (claim 4) of the light-gage plate characterized by cutting the preforming to a slice, being pressureless to the cut preforming and making the fused aluminum or the aluminum alloy which is a matrix permeate it in nitrogen-gas-atmosphere mind — carrying out — (5) — said light-gage plate Let it be a summary to consider as the manufacture approach (claim 5) of the light-gage plate according to claim 3 or 4 characterized by for the thickness being 1-5mm or less, and the magnitude being beyond 100mm angle or more than 100mmphi. It explains to a detail further below.

[0009] As stated above, it considered as the light-gage plate it is supposed that is consisted of metal-ceramic composite material which consists of the aluminum or the aluminum alloy which is the ceramic powder or ceramic fiber which is reinforcement, and a matrix as a light-gage plate of this invention (claim 1).

[0010] Since it becomes a plate with sufficient flatness compared with aluminum or an aluminum alloy since it becomes the plate which has rigidity far higher than aluminum or an aluminum alloy by considering as metal-ceramic composite material as construction material of a light-gage plate, and it becomes the plate which moreover has toughness far higher than the ceramics, it becomes a plate with few cracks and chips than the ceramics.

[0011] As thickness of the light-gage plate, it was referred to as 1-5mm, and carried out to beyond 100mm angle or more than 100mmphi as the magnitude (claims 2 and 5). Since it not only can take out flatness with a comparatively sufficient precision, but heat conduction will worsen even if it is aluminum or an aluminum alloy if the thickness of a plate is thicker than 5mm, as components used for a heater plate, it is not desirable. Moreover, taking out flatness with a precision sufficient irrespective of the property of a raw material, if thinner than 1mm has small effectiveness, when it becomes difficult and the magnitude is smaller than 100mm angle or 100mmphi.

[0012] As the manufacture approach of the light-gage plate, preforming is formed for the ceramic powder or ceramic fiber which is reinforcement. It is pressureless to the preforming in nitrogen-gas-atmosphere mind, make the fused aluminum or the aluminum alloy which is a matrix permeate it, and composite material is produced. The manufacture approach to which it is supposed that the composite material is cut to a slice (claim 3), Or preforming is formed for the ceramic powder or ceramic fiber which is reinforcement. The preforming was cut to the slice and it considered as the manufacture approach carried out to it being pressureless to the cut preforming, and making the fused aluminum or the aluminum alloy which is a matrix permeate it in nitrogen-gas-atmosphere mind (claim 4).

[0013] The manufacture approach of the composite material by this penetration method Other powder-metallurgy processing, a high pressure casting process, Compared with vacuum casting etc., content of the ceramics can be made highly and wide range. Moreover, since cost with an unnecessary large-sized manufacturing facility is the approach which was [be / it / cheap] excellent and production cost can moreover cut composite material or preforming to a slice in a cheap top compared with the ceramics Since the plate of remarkable number of sheets is producible at once while the thickness of a plate is easily controllable, it becomes the manufacture approach far cheaper than the ceramics.

[0014]

[Embodiment of the Invention] If the manufacture approach of the composite material of this invention is described in more detail, ceramic powder or ceramic fiber, such as SiC, aluminum2O3, and AlN, will be prepared as the ceramic powder which is reinforcement first, or ceramic fiber, and the ingot of the aluminum alloy which contains Mg as an aluminum alloy made to permeate this will also be prepared.

[0015] Preforming is formed for the prepared ceramic powder or ceramic fiber. Contact the ingot of the aluminum alloy prepared for obtained preforming, and it is pressureless, the aluminum alloy which heat-treated and fused it at the temperature of 700-900 degrees C in nitrogen-gas-

atmosphere mind is made to permeate, it cools, and composite material is produced. Machining cuts the obtained composite material to a slice, and a light-gage plate is produced.
[0016] In cutting preforming to a slice, machining cuts to a slice in the raw phase of the preforming, the ingot of the aluminum alloy prepared for the cut preforming is contacted, it is pressureless, and the aluminum alloy which heat-treated and fused it at the temperature of 700-900 degrees C in nitrogen-gas-atmosphere mind is made to permeate, is cooled, and a light-gage plate is produced.
[0017] if a light-gage plate is produced by the above approach — aluminum or an aluminum alloy — flatness — good — the ceramics — a crack and a chip — hard — moreover, the cheap light-gage plate of cost is obtained.
[0018]
[Example] The example of this invention is concretely given with the example of a comparison below, and this invention is explained more to a detail.
[0019] (Example 1)
(1) The amount from which silica solid content serves as 2 weight sections in colloidal silica liquid as a binder at it was added using the commercial SiC powder 70 mass section of #180 (mean particle diameter of 66 micrometers), and the commercial SiC powder 30 mass section of #500 (mean particle diameter of 25 micrometers) as production reinforcement of a light-gage plate, to it, further, as a defoaming agent, the FO master VL (product made from SANNOBUKO) was mixed in the 0.2 weight section, and ion exchange water was mixed with 24 weight ****** and a pot mill for 12 hours.
[0020] After slushing the obtained slurry into the rubber die from which the Plastic solid of a phi300xt70mm disk is acquired, putting it for 24 hours, settling SiC powder and cloth's etc. removing top finishing liquid, put it into the freezer compartment, it was made to freeze for 30 hours, and was unmolded. The acquired Plastic solid was calcinated at the temperature of 1000 degrees C, and the powder filling factor formed preforming of 70 volume %.
[0021] The ingot of the aluminum alloy of an aluminum-3Mg presentation was contacted to obtained preforming, it cooled and composite material was produced, after carrying out pressureless osmosis of the aluminum alloy which heat-treated it for 24 hours and fused it at the temperature of 825 degrees C in nitrogen-gas-atmosphere mind. The obtained composite material was cut in thickness of 5mm by the wire saw, and the light-gage plate was produced.
[0022] (2) the 4x3x40mm test piece was cut down from assessment profit **** composite material, and the rigidity was investigated with the resonance method. Moreover, similarly the 4x3x40mm test piece was cut down from the obtained composite material, and the toughness was investigated by the Chevron notch method. Furthermore, the flatness of the obtained plate was measured, the flatness when heating it at 150 degrees C was also measured, and change of the flatness was investigated. Consequently, although rigidity was smaller than the ceramics at 270GPa(s), it was farther [than the below-mentioned aluminum alloy] large. Moreover, although toughness was inferior to the aluminum alloy by 3/2 9.8x106 N/m, it was farther [than the below-mentioned ceramics] large. Furthermore, when the flatness of a plate was heated at 150 degrees C by 15 micrometers, it changed to 50micro. These values were farther [than the plate which consists of an aluminum alloy] small.
[0023] (Example 2) Considered as the Plastic solid with which a phi200x50mm disk is obtained instead of the disk of an example 1, and thickness of a plate was set to 3mm, and also the plate was produced and evaluated like the example 1. Consequently, although rigidity was smaller than the ceramics at 265GPa(s), it was farther [than the below-mentioned aluminum alloy] large. Moreover, although toughness was inferior to the aluminum alloy by 3/2 10.0x106 N/m, it was farther [than the below-mentioned ceramics] large. Furthermore, the flatness of a plate was farther [than the plate which will change to 45 micrometers if it heats at 150 degrees C by 12 micrometers, and consists of an aluminum alloy] small.
[0024] (Example 3) Considered as the Plastic solid with which a corner guard with a 100x100x thickness of 40mm is obtained instead of the disk of an example 1, and thickness of a plate was set to 1mm, and also the plate was produced and evaluated like the example 1. Consequently, although rigidity was smaller than the ceramics at 267GPa(s), it was farther [than the below-

mentioned aluminum alloy] large. Moreover, although toughness was inferior to the aluminum alloy by 3/2 10.1x106 N/m, it was farther [than the below-mentioned ceramics] large. Furthermore, the flatness of a plate was farther [than the plate which will change to 35 micrometers if it heats at 150 degrees C by 8 micrometers, and consists of an aluminum alloy] small. If this is the light-gage plate of this invention when it is described including examples 1 and 2, flatness is better than aluminum or an aluminum alloy, and it shows from the ceramics a crack and that be hard to lack and it can consider as the cheap light-gage plate of cost.

[0025] (Example 1 of a comparison) For the comparison, construction material of a light-gage plate was used as the aluminum alloy (a commercial item, A5052) instead of composite material, and the example 1 of a comparison estimated it the example 1 similarly. Consequently, rigidity was farther [than composite material] small at 72GPa(s). Moreover, the flatness of a plate was farther [than the plate with which the change to which it heats and flatness changes from having changed to 150 micrometers when heated at 150 degrees C by 30 micrometers not to mention the original flatness also consists of composite material] large.

[0026] (Example 2 of a comparison) For the comparison, construction material of a light-gage plate was made into alumimium nitride (a commercial item, 99% of purity) instead of composite material, and the example 2 of a comparison estimated it the example 1 similarly. Consequently, although rigidity was larger than composite material at 315GPa(s), its toughness was farther [than 3/2 and composite material] small 4.0x106 N/m.

[0027]

[Effect of the Invention] if it is the light-gage plate of this invention as above -- aluminum or an aluminum alloy -- flatness -- good -- the ceramics -- a crack and a chip -- hard -- moreover, it can consider now as the cheap light-gage plate of cost. It can be expected now that this will be used for the heater plate with which this light-gage plate is used for semiconductor fabrication machines and equipment etc., a chip heating plate, or the plate for heating.

[Translation done.]